Ontario Geological Survey

Northern Ontario
Engineering Geology Terrain Study 75

FOLEYET AREA

(NTS 42B/SE)

Districts of
Algoma, Cochrane, and Sudbury

by

Hulbert A. Lee and S.A. Scott

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MAP
(accompanying report)

Map 5102 (coloured) – Northern Ontario Engineering Geology Terrain Study, Data Base Map, Foleyet (NTS 42B/SE). Scale 1:100 000.

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Hulbert A. Lee[1] and S.A. Scott[2]

1.0 INTRODUCTION

This report accompanies a Data Base Map (OGS Map 5102) which characterizes the terrain in the Foleyet map-area, Districts of Algoma, Cochrane, and Sudbury by means of letter symbols that relate directly to reconnaissance engineering conditions. The area, which covers NTS block 42B/SE, lies between Latitudes 48°00'N and 48°30'N and Longitudes 82°00'W and 83°00'W. The report is one of a series which provides uniform terrain data for approximately 370 000 km^2 of northern Ontario.

The purpose of the mapping is to provide complete data coverage which can then be utilized for engineering and resource planning. The ex-

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planatory notes in this report are intended to expand on characteristics of the terrain units that are specific to the Foleyet map-area, and to describe the engineering significance of the units.

The primary method of mapping was airphoto interpretation, using existing black and white photographs at a scale of approximately 1:50 000. Prior to interpretation, both a literature search and ground reconnaissance were carried out. Preliminary data thus obtained, including geology, outcrop distribution, and relief, were plotted on a copy of the base map. A quick overview of the map-area was gained from both colour and black-and-white satellite imagery. Ground reconnaissance consisted of travelling through all accessible areas by road and rail, making terrain observations, sampling soil materials, and taking photographs. Thus the map represents a reconnaissance level presentation of engineering conditions.

An engineering terrain legend was developed to facilitate the mapping and to provide a common information base for the entire map series. This legend is shown on the accompanying Data Base Map. The letter symbols function as a shorthand, describing surface materials, genetic landforms, topography, and drainage. Further information on the mapping techniques, legend format, and possible uses of the terrain data is available in the "Ontario Engineering Geology Terrain Study Users' Manual" (Gartner, Mollard, and Roed 1980), a companion publication to this series of maps and reports.

2.0 GEOLOGICAL SETTING

The Foleyet map-area is drained northward by the Ivanhoe, Nemegosenda, and Groundhog Rivers and their tributaries. Local relief varies from low to high, and the land surface is undulating to steeply and abruptly sloping. Elevations (above mean sea level) range from 305 m in the north to 430 m in the south, with hills reaching a maximum elevation of 520 m.

2.1 BEDROCK

All bedrock underlying the Foleyet map-area is of Early Precambrian (Archean) age, with the exception of a Late Precambrian mafic to

intermediate intrusive body in the northwestern part of the area. A series of subparallel outcrop belts crosses the map-area in a northeasterly direction. The rocks are all firm for engineering purposes. The area has been mapped on a reconnaissance basis (Thurston, Siragusa, and Sage 1971, 1977), with parts having been studied in more detail by Todd (1924), Harding (1938), Prest (1950), and Bennett (1966a, 1966b, 1969).

Coarse-grained granulites of the Kapuskasing gravity high underlie all of Sherlock and Shenango Townships and parts of surrounding townships in the northwestern part of the area. They form rock knobs of medium to high local relief, with undulating to steeply sloping surfaces. Adjacent to the south is a band of dark, mafic, coarse-grained rocks of anorthosite-gabbro composition (the Shawmere Anorthosite Complex) which occupies much of Lemoine, Paul, Warren, Carty, Murdoch, and Evans Townships, and parts of Lincoln, Foleyet, and Pinogami Townships. They form rock ridges and rock knobs, with medium to high relief and steep slopes, which give rise to long, narrow, northeast-trending lakes, such as Ivanhoe and Lemoine Lakes.

The southeastern third of the map-area is underlain by metavolcanic, metasedimentary, and mixed granitic intrusive rocks. North of central Muskego and Reeves Townships, the rocks are chiefly granitic intrusives and hybrid migmatites. Local relief in the southeastern third varies from low to high. The land surface is undulating to steeply-sloping, the chief landforms being rock plains and rock knobs.

2.2 SURFICIAL

Data on surficial geology is contained on a reconnaissance map compiled by Boissoneau (1965), but to date there has been no systematic detailed study of the map-area.

A north-northeastward withdrawal of ice margins during Wisconsinan time left behind glaciofluvial esker systems such as the large complexes passing through Ivanhoe and Penhorwood Townships. Ice flow behind these shrinking margins laid down a sandy, bouldery till. A glacial lake was impounded in the basins now occupied by the Groundhog and Ivanhoe Rivers; it was confined between the ice margin to the north and high ground to the south. Lake plain silt and varved silt and clay were deposited in the lake basins at that time.

Organic terrain, consisting mainly of sphagnum peat, has developed since deglaciation in confined bogs within the poorly-drained areas.

3.0 DESCRIPTION OF ENGINEERING TERRAIN UNITS

The terrain units described below are arranged by landform in descending order of areal importance within the Foleyet area. A representative selection of terrain unit symbols is given for each landform, each with accompanying explanation. This treatment is meant to familiarize the reader with the meaning of the legend symbols, and allow more effective use of the Data Base Map (OGS Map 5102, accompanying this report). A discussion of the engineering significance of the various terrain units is given in Section 5.0.

3.1 BEDROCK

RN(tMG) / Mnj-D RN(tMG) (pOT) / Mnj-D

Rock knobs (RN), with ground moraine till (tMG) and local patches of bog (pOT), characterize the bedrock terrain in central Sherlock Township. The local relief is between 15 and 60 m. The land surface is knobby (n), rugged (j) in places, and dry (D).

tMG/RN(pOT) / Muj-M tMG/RN / Hsn-D

tMG/RN / Msn-D

Rock knobs (RN) are the dominant engineering factor in this bedrock terrain, which occurs in Kapuskasing, Shenango, and Lincoln Townships. The bedrock has a cover of 1 to 2 m of till (tMG), and locally there are scattered bogs in the depressions (pOT). The relief is generally 15 to 60 m (M) or occasionally greater than 60 m (H). The land surface is either undulating (u), steeply sloping (s) and rugged (j), or knobby (n). Surface drainage is mixed (M) or dry (D).

RR(tsMG) / Hr-D

Elongated rock ridges (RR), trending northeasterly with associated subordinate amounts of ground moraine sandy till (tsMG), characterize the bedrock terrain in northeastern Lemoine Township and northeastern Foleyet Township. Relief is greater than 60 m. The land surface has multiple ridges (r) and is dry (D).

RN(tMG) / Hsj-D RN(tMG) / Hsn-D

A rock knob (RN), with minor ground moraine till (tMG), forms a high granite hill in northern Oswald Township. Local relief exceeds 60 m. The land surface is knobby (n), with steep slopes (s) and locally jagged cliffs (j); and is dry (D).

RN(cmLP) / Msj-M

Rock knobs (RN), with considerable clay silt lake plain deposits (cmLP), between the knobs, characterize the bedrock terrain of north-central Melrose Township. The local relief is 15 to 60 m, slopes are steep (s) and rugged (j) and drainage is mixed (M).

RP(tMG) / Mu-D

Rock plain (RP), with low outcrops and minor ground moraine till (tMG) characterizes the bedrock terrain of northern Reeves township. The local relief of the unit is 15 to 60 m and the land surface is undulating (u) and dry (D).

RN(tbsMG)(pOT) / Mu-D(D)(W)

RN(tsMG)(pOT) / Hn-D(D)(W)

Rock knob (RN), with considerable intermixed areas of very bouldery sandy till (tbsMG) and bog-filled depressions (pOT), between the knobs, characterize the bedrock terrain in much of Horwood, Keith, Penhorwood, and Hardiman Townships. The local relief is 15 to 60 m (M), occasionally increasing to more than 60 m (H). The land surface is undulating (u) to

knobby (n). Drainage conditions on the bedrock and ground moraine are dry (D), while the organic deposits are wet (W).

3.2 MORAINAL

tsMG(pOT) / Mu-D

Ground moraine (MG), consisting of sandy till (ts), with low drumlin ridges and intervening bogs (pOT), characterizes the morainal terrain in western Sherlock Township. Relief is moderate (M) and the surface is undulating (u) and dry (D).

tMG / Mu-D tMG(pOT) / Lu-D

Ground moraine (MG), consisting of till (t), with low drumlin hills and scattered bogs (pOT), characterizes the morainal terrain in Oswald and Oates Townships.

tsMG(RP) / Mu-M

Ground morane (MG), consisting of sandy till (gs), with scattered low bedrock outcrops (RP), characterizes the morainal unit in Reeves Township. Local relief is 15 to 60 m, the land surface is undulating (u), and drainage is mixed (M).

tbsMG(pOT) / Mu-D(W)

tbsMG(pOT) / Lu-D(W)

Ground moraine (MG), consisting of very bouldery sandy till (tbs), in part drumlinized, with some scattered bogs (pOT), characterizes the morainal terrain of southeastern Penhorwood Township. The relief is 15 to 60 m (M) or, in places, less than 15 m(L). The land surface is undulating (u), dry (D), on the ground moraine, and wet (W), on the organic terrain.

tsMG(sGO) (pOT) / Mu-M

Ground moraine (MG), consisting of sandy till (ts) with numerous areas of outwash sand (sGO), and a few scattered bogs (pOT), characterizes the morainal unit of northern Muskego Township. Local relief

is 15 to 60 m (M) and the land surface is undulating (u) with mixed drainage (M).

3.3 GLACIOFLUVIAL

sgGE(sgMH) (RN) / Muk-D

sgGE / Mnk-D

An esker complex (GE), consisting of sand and gravel (sg), forms the glaciofluvial terrain in Oates and Nova Townships. Hummocky moraine (MH), probably also consisting of sand and gravel, lies subparallel to the esker ridges. This unit contains minor bedrock knobs. Local relief is 15 to 60 m and the surface is kettled (k), undulating (u), or hummocky (n). Drainage is dry (D).

gsGE(MH) / Mnk-D

gsGE(mGO) (tMH) / Mnk(d)-D

An esker complex (GE), consisting of gravel and sand (gs), forms the glaciofluvial terrain in Foleyet Township and northern Ivanhoe Township. Hummocky moraine till (tMH), and outwash silt (mGO) form subordinate units trending subparallel to the esker ridge. Local relief is 15 to 60 m. The land surface is hummocky (n), kettled (k), in places dissected (d), and generally dry (D).

sgGE(RN) (tMH) / Mnk-D sgGE / Mnk-D

An esker complex (GE), consisting of sand and gravel (sg), occurs in southwestern Melrose Township. The sand and gravel occurs around rock knobs (RN), and there is some hummocky moraine till (tMH).

sgGO(tsMH) (pOT) / Mn-D(D) (W)

Outwash (GO), consisting of sand and gravel (sg), and hummocky moraine sandy till (tsMH), trend subparallel to an esker ridge crest in the glaciofluvial unit of Hardiman Township. Local relief is 15 to 60 m and the land surface is hummocky

(n). Drainage on the outwash and hummocky moraine is dry (D), while on the scattered organic terrain it is wet (W).

sgGO / Lpk-D sgGO(pOT) / Mpk-D

sgGO(mLP) (pOT) / Mpu-D(D) (W)

Outwash (GO), consisting of sand and gravel (sg), characterizes the glaciofluvial terrain in Whigham, Silk, and Ivanhoe Townships. Some of this terrain has minor areas of lake plain silt (mLP), and a few confined bogs (pOT). Relief is low (L) or moderate (M). The land surface is planar (p) and may be kettled (k) or undulating (u). Surface drainage conditions are dry (D), except on the larger bogs.

3.4 GLACIOLACUSTRINE

mLP(tMG) / Mu-D mLP / Lu-D

mLP(pOT) / Lp-M

Lake plain silt (mLP) makes up the glaciolacustrine terrain in Ivanhoe, Foleyet and Muskego Townships. There are some low ridges of ground moraine till (tMG). Local relief is low (L) or moderate (M). The land surface is undulating (u), or planar (p) and drainage is dry (D) or mixed (M).

cmLP(RP) / Lp-M sLP / Lp-M

Lake plain deposits (LP), consisting of clay and silt (cm), or fine sand (s), comprise the glaciolacustrine terrain in Melrose Township. There are a few low bedrock outcrops (RP). Local relief is less than 15 m (L), the land surface is planar (p) and drainage is mixed (M).

3.5 ORGANIC

pOT / Lp-W

Organic terrain, composed of peat (pOT), is a name reserved for medium to large areas which are semi-barren of trees and where the confined peat bog is likely to be

of considerable thickness. Examples of this unit are scattered throughout the map-area. The relief is low (L), topography is flat (p), and surface conditions are wet (W).

pOT/sLP
Lp-Dh

Organic terrain, consisting of a thin layer of peat (pOT), overlies lake plain sand (sLP), in the central part of Kapuskasing Township.

pOT(RN)
Lp-W

Organic terrain, composed of peat (pOT) with occasional protruding bedrock knobs (RN), is characteristic of the majority of the organic terrain in Kapuskasing Township. Local relief is low (L) and the land surface is planar (p). Surface drainage conditions are mixed (M), or are such that the water table is within 1 m of the surface (Dh).

pOT/cmLP
Lp-W

Clay and silt lake plain deposits (cmLP) are overlain by a shallow cover of peat organic terrain (pOT) in Strachan Township. Relief is low (L) and the land surface is flat (p), and wet (W).

3.6 ALLUVIAL

mAP(pOT)
Lp-Dh

smAP
Lp-D

scAP
Lpt-D

An alluvial plain (AP), consisting of silt (m), sand and silt (sm), or sand and clay (sc), occurs along the Ivanhoe River in the central and north-central parts of the map-area. Relief is low (L) and the land surface is planar (p), or terraced (t). Drainage conditions are dry (D) or such that the water table is within 1 m of the surface (Dh).

4.0 OBSERVATION NOTES

The following brief notes refer to sites in the Foleyet map-area at which ground observations were made. The corresponding numbered locations can be found on the Data Base Map. Where there are a number of drill holes indicated for one locality, a single central position for the group is shown on the map.

Observation Site	Description
1	12 m face; gravelly sand
2	18 m face; esker node gravel
3	Esker gravelly sand; terrain is ridged, has moderate relief, and is dry
4	Over 1 m of sand and boulders (wave-washed till); sandy till at depth
5	Granite rubble on surface
6	5 m crushable esker gravel, sand on flat below esker
7	Lake plain silty sand; terrain is dry with low relief
8	Over 2 m of lake plain sand; terrain is dry with low relief
9	River flows below esker hills; 28 m of coarse gravel
10	Lake plain sandy silt exposed in a roadcut, eroded into terraces on slopes, and deep ravines. relief is moderate
11	About 2 m of fine sand overlying 15 m of crushable gravel in esker; water table level is not exposed
12	Silty alluvial plain; terrain is low, rolling, and dry with locally high water table; drift thickness of 28 m from water well data (Ontario Water Resources Commission 1972)

13 Low esker with relief of 2 m

14 Bouldery sandy till ground moraine; terrain has low undulating relief, and is dry and gullied; resistance to penetration by pocket penetrometer is 980 kPa (140 psi)

15 Silty bouldery till; non-plastic; resistance to penetration by pocket penetrometer is 2750 kPa (400 psi)

16 Over 1 m of silt with minor clay forms a floodplain; material is impermeable and supports shallow surface streams which transport silt and cause blocked culverts

17 Sandy till

18 High esker (25 m)

19 20 m section of gravel and sand exposed at edge of railway

20 Silt glaciolacustrine plain; extensively dissected; relief is moderate; terrain is rolling and dry with locally high water table, it is not capable of adequately supporting railway structures

21 Lake plain composed of thick silt provides poor foundation conditions for railroad; terrain has low relief, and is gullied and dry

22 Glaciolacustrine silt overlies esker sand and gravel

23 Over 1 m of dry, hard silt

24 Sand ridge

25 Depth of soil varies from 5 m to more than 32 m (determined from 4 boreholes). Drill log: sand, gravel, and boulders near base; 'granite' (Ontario Water Resources Commission 1972)

26 Depth of soil ranges from 29 to 36 m (determined from 3 boreholes). Drill log: patches of sand; clay; 'red granite';

'grey granite'; 'shale' (Ontario Water Resources Commission 1972)

27 Depth of soil ranges from 3 to 6 m (determined from 3 boreholes). Drill log: 'brown clay'; boulders; 'granite' (Ontario Water Resources Commission 1972)

28 Sandy silt alluvial plain; surface is dry, but with a high water table

29 0.5 m of silt overlies sandy, silty till; the silt unit thickens rapidly towards lake basin to the south

30 20 m of coarse gravel and sand in esker node

31 Alluvial plain composed of silt; generally dry, but with a high water table

5.0 ENGINEERING AND RESOURCE SIGNIFICANCE

Principal resources of the Foleyet map-area are minerals, gravel and sand aggregate, and forestry.

The Abitibi Volcanic Belt, famous for mineral deposits in Ontario and Quebec, passes through this map-area. The rocks have been metamorphosed adjacent to the Kapuskasing gravity high, a factor which has made mineral exploration difficult. There are numerous occurrences of base metal sulphides and gold in the southeastern half of the map-area. The Penhorwood talc mine is in production in Reeves Township; iron ore has been removed from a pit in northwestern Penhorwood Township; and there is a copper-gold deposit in Keith Township which has been mined in the past.

An important potential source of gravel aggregate is located in Ivanhoe and Foleyet Townships, adjacent to the eastern boundary of Ivanhoe Lake Provincial Park.

A spectacular 28 m high face of coarse crushable gravel is exposed on both sides of the Ivanhoe River (new channel) in the central part of the

map-area. At observation site 11, there is a 15 m exposed section of crushable gravel, and at site 19 there is a 20 m section of gravel and sand. This area appears to have potential for gravel production on a broader-than-local scale and should be tested for tonnage and quality. Other sand and gravel resources are located in the esker complex passing through Hardiman, Penhorwood, and Reeves Townships, in the southeastern part of the map-area.

Manageable forestry lands are restricted to the morainal, glaciolacustrine, and glaciofluvial units. They tend to be scattered and discontinuous, making effective management difficult.

5.1 BEDROCK TERRAIN

More than half of the Foleyet map-area has bedrock within 2 m of the surface, a factor which affects most types of construction. Few areas of bedrock terrain have low local relief; most of the bedrock in the area is of medium and high relief, occasionally with an undulating surface, but commonly with steep slopes and, in places, rugged and jagged surfaces. These areas will present the following difficulties for engineering and resource management:

1. blasting required for most types of below-ground excavations;

2. site-regrading due to steep slopes;

3. cut-and-fill operations, requiring blasting of bedrock for major transportation routes or the acceptance of considerable vertical and horizontal alignments;

4. lack of good and reliable sources of ground water, unless aquifer fractures are intersected in drilling; and

5. difficult environments for disposal of solid and toxic wastes.

Number 5 is less of a problem in areas where ground moraine or lake plain deposits overlie rock.

5.2 MORAINAL TERRAIN

The ground moraine till in the Foleyet map-area has nearly equal proportions of sand and silt, and a low content of clay; it is commonly bouldery. A sample of the till from observation site 14 in Muskego Township, tested at the Geoscience Laboratories, Ontario Geological Survey, yielded a size fraction analysis of clay 3%, silt 45%, and sand 52%. Total carbonate was low at 3%. A sample from observation site 15 in Penhorwood Township gave a result of clay 4%, silt 53%, and sand 43%. Total carbonate was low at 4%. Resistance to penetration by a hand penetrometer was 2750 kPa (400 psi).

This till is non-plastic, generally dry, and has a good bearing strength. It is moderately difficult to excavate because of the boulders. Conditions are good for septic tank, liquid, and solid waste disposal systems. Ground water supply from the till is generally low.

5.3 GLACIOFLUVIAL TERRAIN

Many of the esker complexes have moderate local relief and are sinuous in form, thus necessitating cut-and-fill operations to overcome the problems of gradients on steep slopes. Horizontal route alignments will be necessary around numerous small lakes. The ground water table, as indicated by the level of water in kettle holes, is commonly low, resulting in a dry land surface. Septic tank installation will require grading. Liquid waste disposal may cause pollution problems because of the permeable nature of the underlying gravel and sand.

The outwash terrain is of low to moderate relief, and both trafficability and road construction involve fewer problems of alignment and cut-and-fill than in esker terrain. The water table is not as deep as in the high esker complexes, and there is normally a good supply of ground water. In the coarser soils of the outwash terrain, there is a hazard of pollution from septic and liquid waste disposal systems. The bearing strength is good on both esker and outwash materials, and excavation and workability of the soil is normally good.

5.4 GLACIOLACUSTRINE TERRAIN

Much of the glaciolacustrine terrain is composed of silt, and wherever

it is elevated, dissection into deep narrow ravines and gullies is extensive. Where the material has been used as fill for railway embankments, it has been subject to wash-outs and has resulted in poor railroad bed conditions. Attempts have been made to control washouts on highway slopes by grading to low terracettes. This fine-grained soil reacts unfavourably to frost action; hence, design of footings, small slabs, and roadways will have to take this factor into account. Otherwise, these soils are suitable for habitation construction.

5.5 ORGANIC TERRAIN

Drainage, flooding, and settlement problems associated with the organic terrain units makes them generally poorly suited for roads and foundations. Because construction materials are not available locally, engineering project costs are higher. The organic terrain units include the following varieties: (a) bog only, in which construction conditions are unsuitable; (b) bog and another unit in almost equal proportions, in which scattered parts of the unit are satisfactory for habitation; and (c) a thin layer of organic material overlying another unit, in which road construction costs will be lower than in areas consisting exclusively of bog, although considerable testing is required.

5.6 ALLUVIAL TERRAIN

Overflow banks and flood scars are found along portions of the Ivanhoe River. These alluvial plains are usually composed of micaceous silt and local patches of peat. Construction conditions are generally poor in the alluvial terrain.

Problems include poor trafficability, settlement of soft ground, dewatering of excavations where the water table is high, absence of suitable earth materials, and flooding. The installation of permanent structures is not recommended.

6.0 REFERENCES

Bennett, G.

1966a: Nova Township, District of Cochrane; Ontario Department of Mines, Preliminary Map P.346, scale 1 inch to ½ mile. Geology 1965.

1966b: Strachan Township, District of Cochrane; Ontario Department of Mines, Preliminary Map P.347, scale 1 inch to ½ mile. Geology 1965.

1969: Geology of the Belfor'-Strachan Area, District of Cochrane; Ontario Department of Mines, Geological Report 78, 30 p. Accompanied by Maps 2181 and 2182, scale 1:31 680 or 1 inch to ½ mile.

Boissoneau, A.N.

1965: Surficial Geology, Algoma-Cochrane; Ontario Department of Lands and Forests, Map S365, scale 1:506 880 or 1 inch to 8 miles. Surficial geology 1962, 1963.

Gartner, John F., Mollard, J.D., and Roed, M.A.

1980: Ontario Engineering Geology Terrain Study Users' Manual; Ontario Geological Survey, Open File Report 5288, 99 p.

Harding, W.D.

1938: Geology of the Horwood Lake Area, Ontario Department of Mines, Vol. 46, Pt. 2 (1937), 34 p. Accompanied by Map 46a, scale 1:63 360 or 1 inch to 1 mile.

Ontario Water Resources Commission

1972: Water Well Records for Ontario, Northern Area, 1946-1969; Ontario Water Resources Commission, Water Resources Bulletin 2-9, Ground Water Series.

Prest, V.K.

1961: Geology of the Keith-Muskego Townships Area; Ontario Department of Mines, Vol. 59, Pt. 7 (1950), 44 p. Accompanied by Map 1950-4, scale 1:12 000 or 1 inch to 1,000 feet.

Thurston, P.C., Siragusa, G.M., and Sage, R.P.

1971: Operation Chapleau, Horwood Lake Sheet, Districts of Algoma, Cochrane, and Sudbury; Ontario Department of Mines and Northern Affairs, Preliminary Map P.673, Geological Series, scale 1 inch to 2 miles. Geology 1970.

1977: Geology of the Chapleau Area, Districts of Algoma, Sudbury and Cochrane; Ontario Geological Survey, Geoscience Report

157, 293 p. Accompanied by Maps 2221, 2351, and 2352, scale 1:253 440 or 1 inch to 4 miles.

Todd, E.W.

1925: Groundhog River Area; Ontario Department of Mines, Vol. 33, Pt. 6 (1924), p. 1-17. Accompanied by Map 33g, scale 1:95 040 or 1 inch to 1½ miles.

MAPS
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